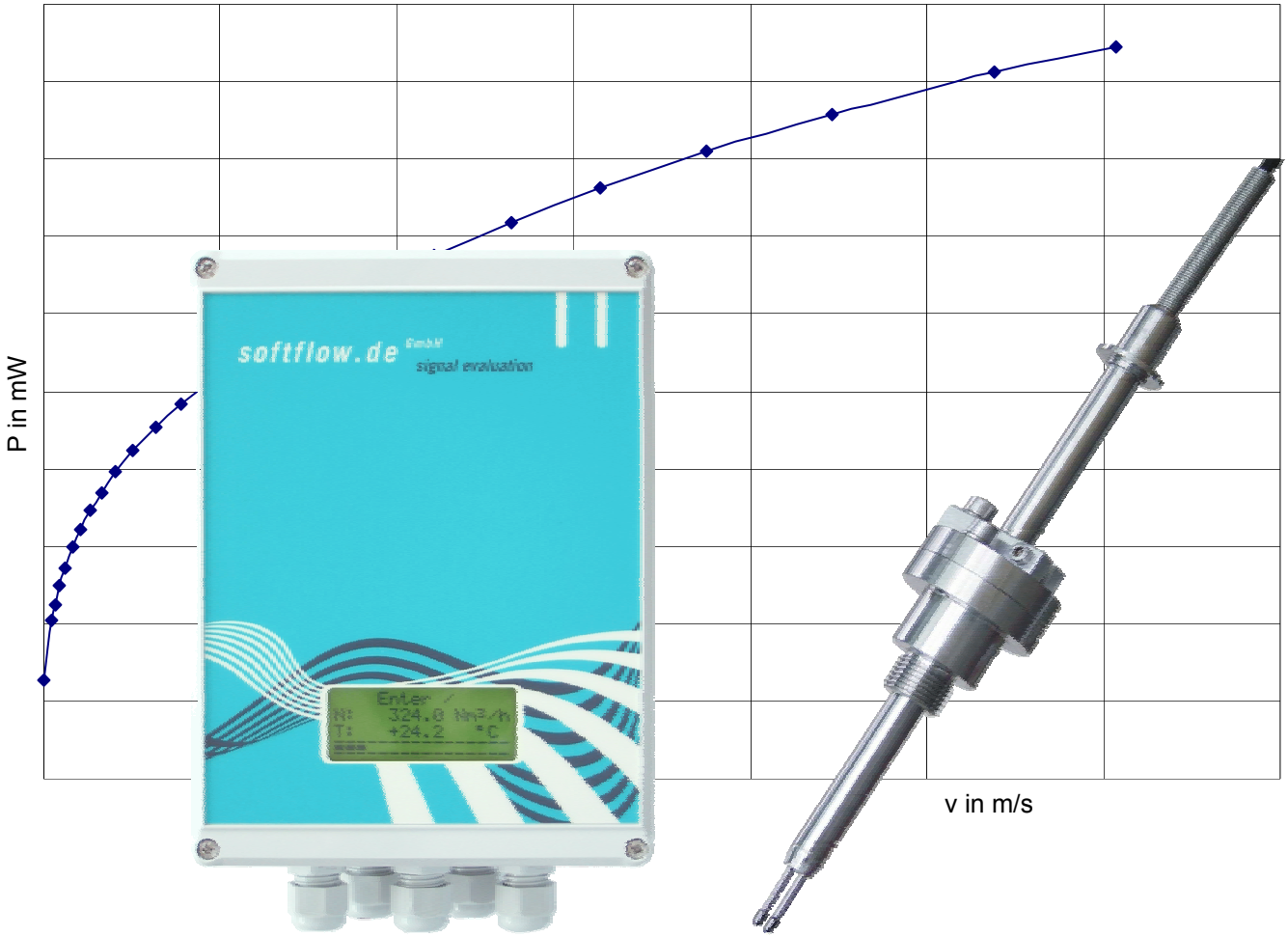
INSTALLATION AND OPERATING INSTRUCTIONS

THERMAL MASS FLOWMETER and TEMPERATURE TRANSMITTER TYPE SF-586b for GASES



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IMPORTANT NOTE

Before installation and commissioning the unit the operating instructions must be read extremely carefully to avoid possible damage which may invalidate the warranty.

The unit must only be used for the operating conditions as described in the specification.
All other usage is excluded.

The sensor, especially the ends of the probe are very sensitive detecting elements, which have to be protected against shocks or other mechanical damage.

1. Theory of operation

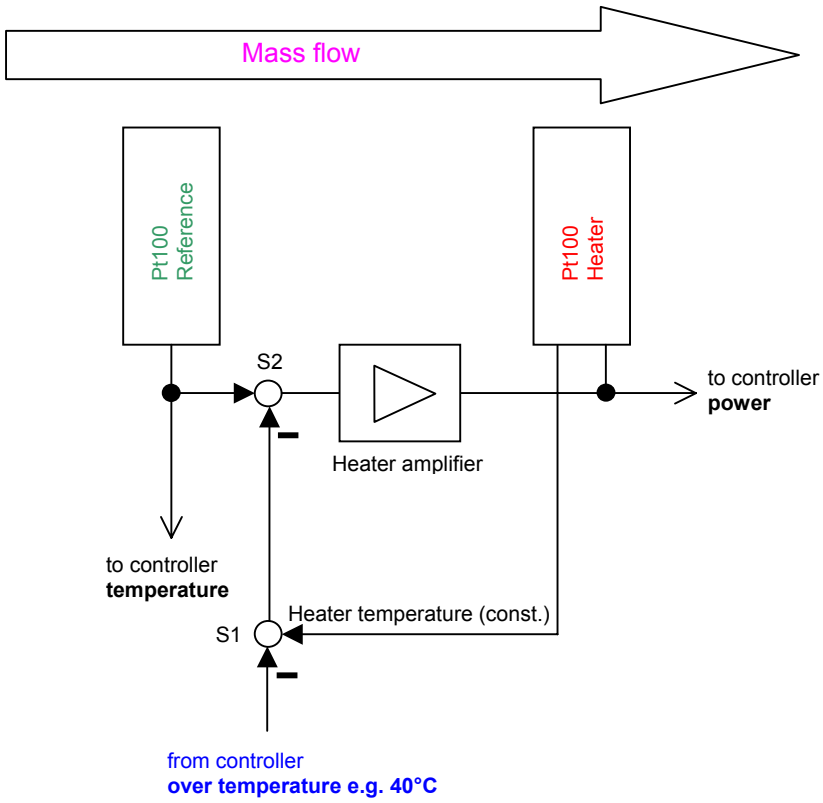
The calorimetric measurement principle based on the physics of heat dissipation, from an element with a higher temperature than its surrounding medium, liquids or gases, effected by flowing, density and special properties of the medium.

The amount of energy is a function of the temperature difference Δt and the mass flow. The Softflow.de thermal measurement principle works with the following method:

The temperature difference Δt between the *Tref*-sensor and *Theat*-sensor is kept constant by an electrical heating.

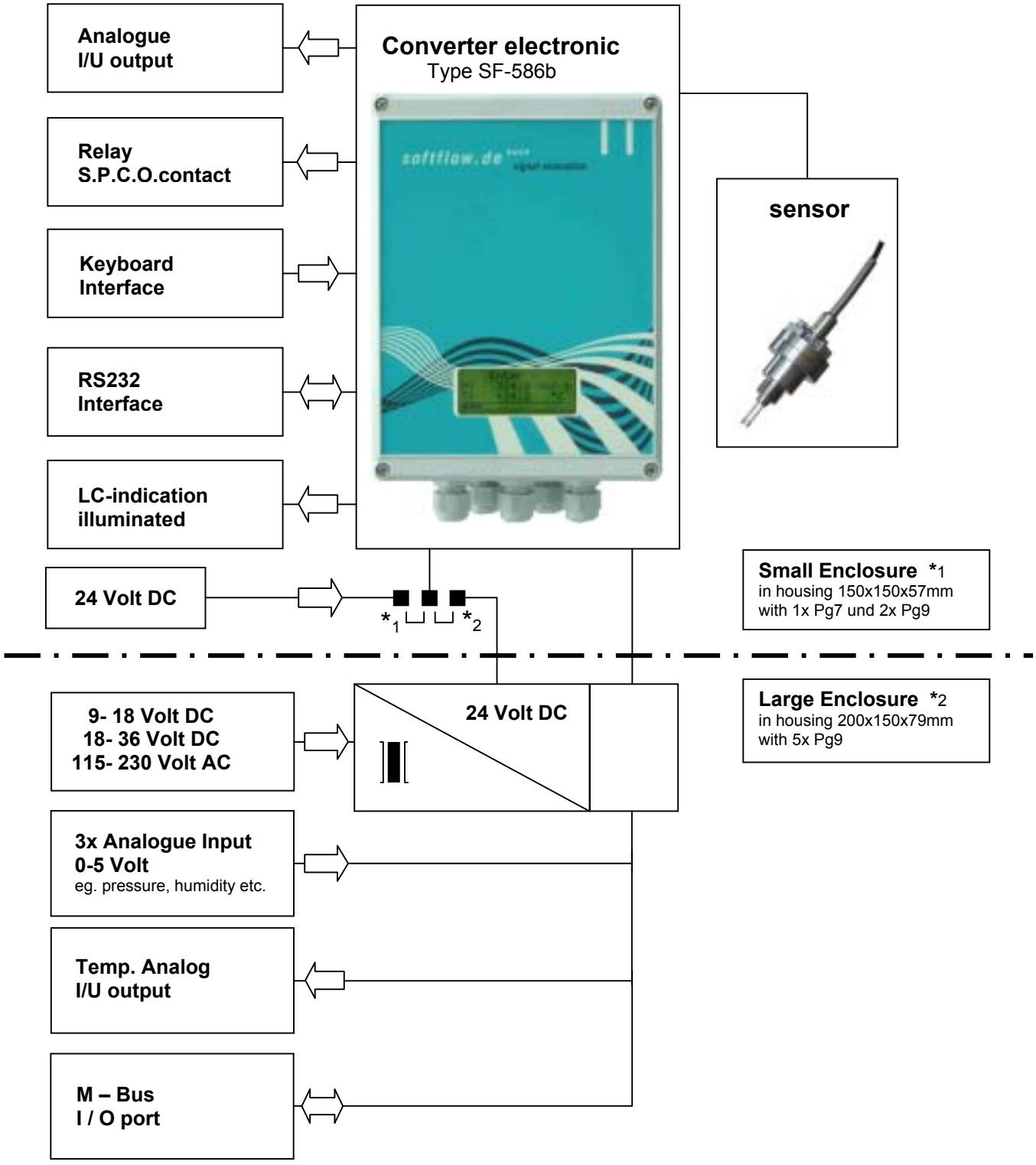
One of the sensors measures the temperature of the medium, the second sensor is heated up directly, without any aditional heater element, to the constant over temperature. Softflow.de is using a high precision controller for controlling the Δt, Softflow.de don't use a Wheatstone Bridge.

The required calorific power is a function of the mass flow and can be used for the evaluation.



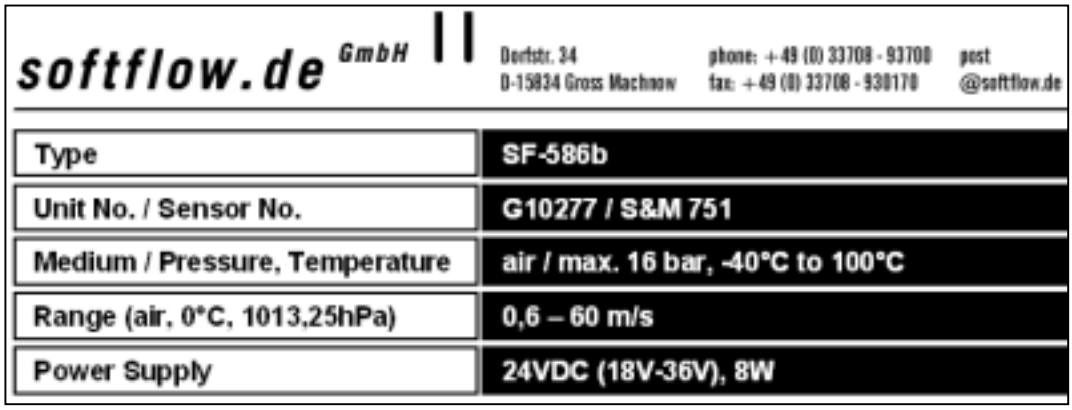
2. General

The unit comprises of a probe-type sensor for installation in the line with separate converter electronics. Both parts are interconnected by cable. The cylindrical shape of the sensor allows ease installation into the pipe line.



3. Serial number

The sensor is calibrated together with the electronic converter.
The calibration curve is stored in an EEPROM on the electronic converter.
When installing, it is important, to use always the parts of sensor and electronic that belongs together.
On the electronic housing you can find a table with information about the sensor and the electronic. In the second line are the electronic number (G10277) and the sensor number (S&M751). The sensor number is short below the cable protection on the upper end of the sensor.



4. Operation and construction of the sensor

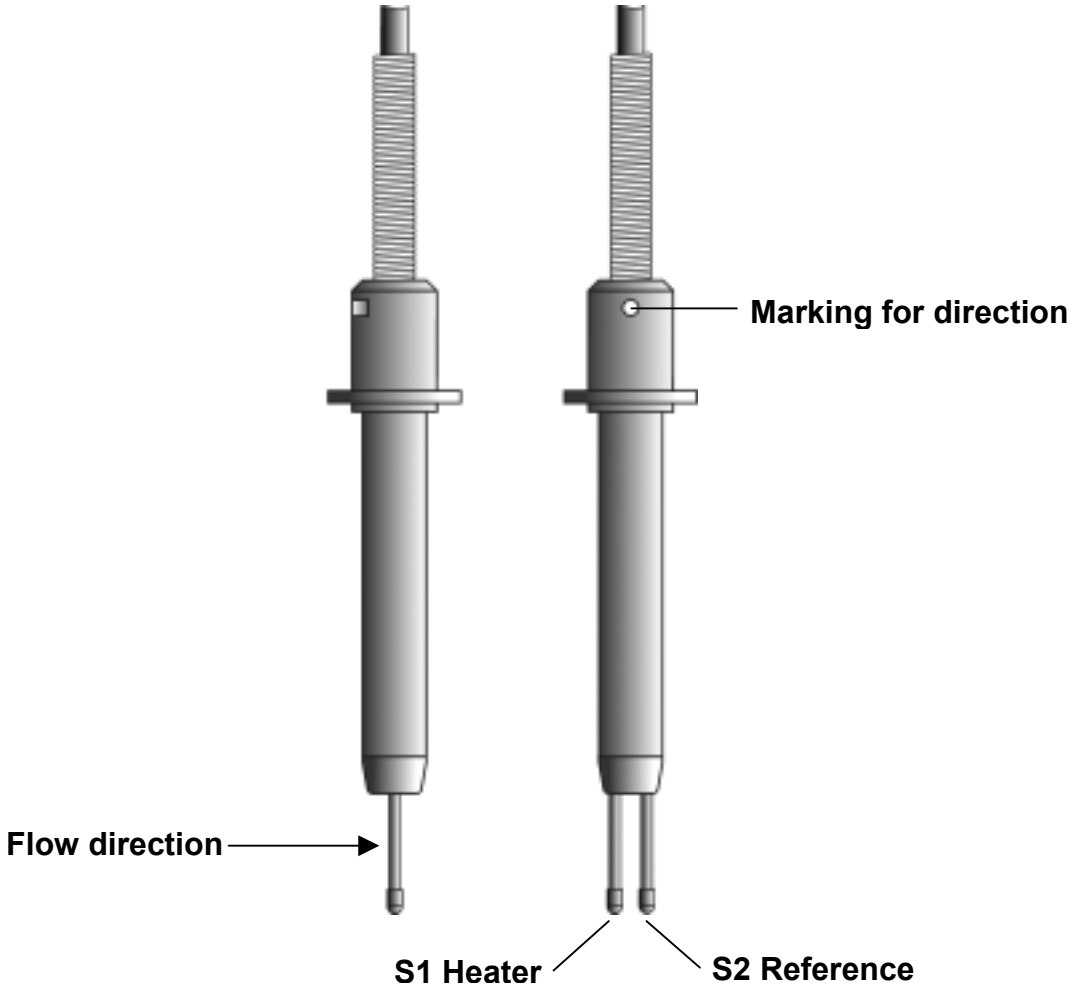
The sensor consists of a cylindrical shaft. At the bottom end are the two sensors elements.

The sensor element **S2** (reference) registers the actual medium temperature.

The sensor element **S1** (heater) is controlled via the converter electronic to a constant over temperature above medium temperature.

The passing medium causes of loss of energy at sensor **S1**.
The required calorific power is a function of the mass flow and can be used for the evaluation.

The connecting cables of the sensor elements are led via the shaft of the probe and connected within the unit's head with the mains cable.



5. Installation and starting of the sensor

5.1 Preparing the measuring section

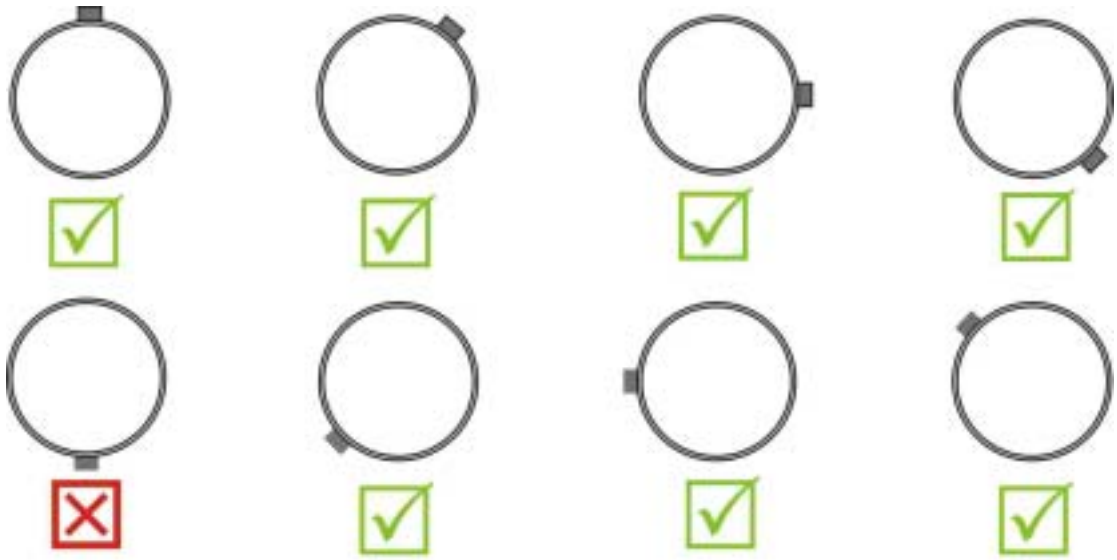
Pipeline must be pressureless!

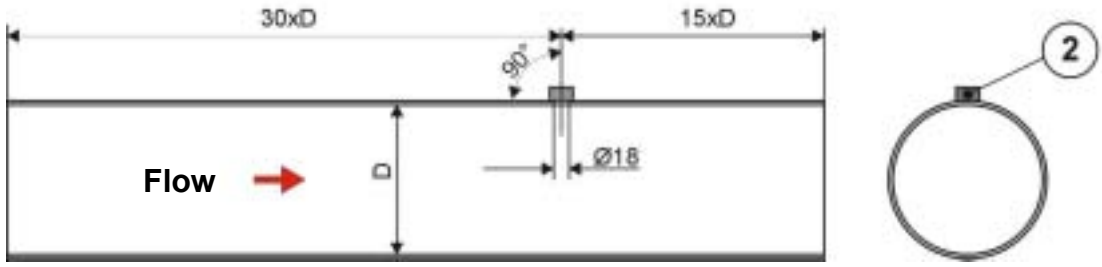
The pipeline must be dry and clean!

Using pipelines greater than DN50 only a welding socket and a hole with a diameter of 18mm is necessary.

The mounting position of the welding socket in the pipe must be upstream 30 x pipe-diameter and downstream 15 x pipe-diameter.
These distances are essentially for generating a stationary flow profile.
When mounting with these distances is impossible the using of a flow straightener is necessary or the profile of flow must be determined.

In pipes with a circularly cross section the mounting on nearly every position on the perimeter is possible. A mounting in the bottom position is critical, because condensate can influence the measuring result.
The mounting of the welding socket must be right-angled to the flow direction.



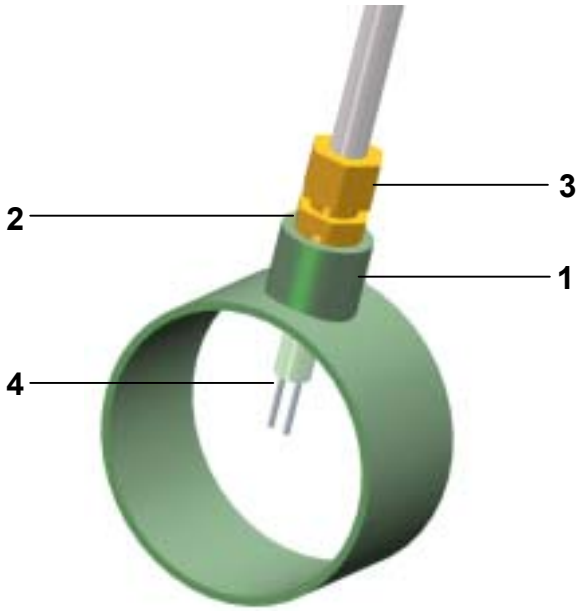


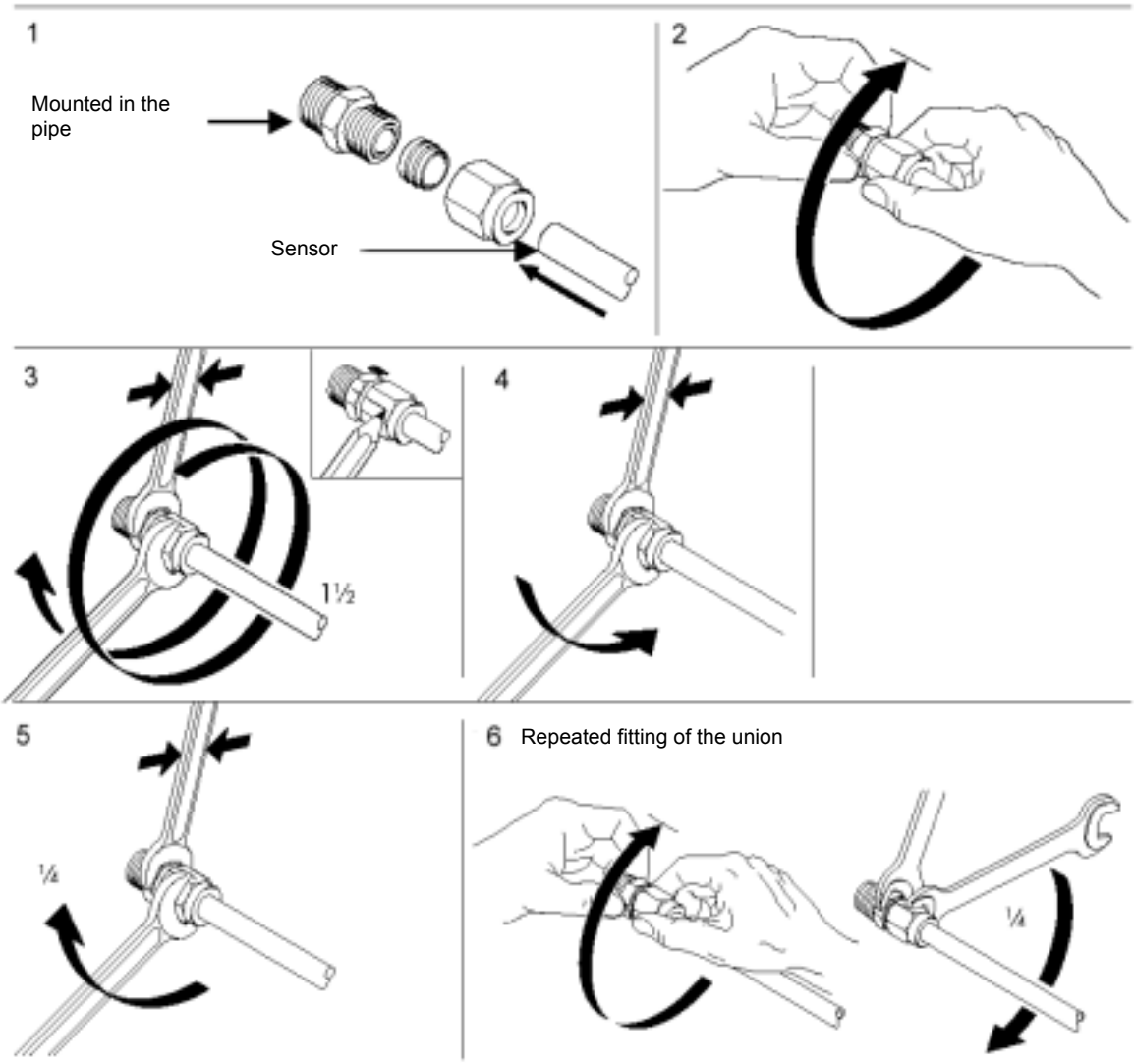
5.2 Installation with compression ferrule

On standard circular pipes the socket can be situated in any position. Please avoid to install the sensor to the bottom of the pipe, it might happen, that condense influences the measurement.

Please proceed as follows:

- Screw the compression ferrule **2** into the welding socket **1** (use suitable sealing). **Attention!** Do not tighten the coupling nut **3** in this stage.
- Insert the sensor **4** in axial direction until the required insertion depth is reached.
- Align the sensor into direction of flow. The marking point at the upper end of the sensor shaft marks the upstream direction of flow.
- Now fix the ferrule nut **3** to the compression ferrule. **Attention!** After that the axial position of the sensor remains fixed.



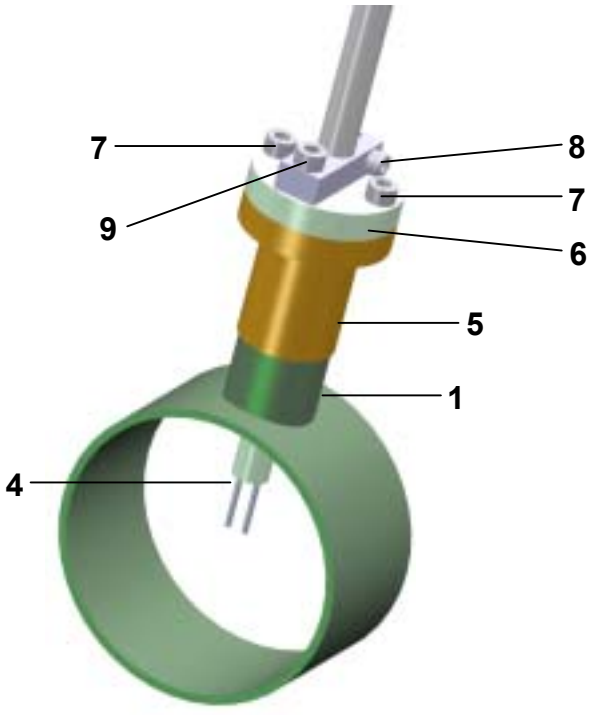

1
Mounted in the pipe
Sensor
2
3
1½
4
5
¼
6 Repeated fitting of the union
¼

5.3 Installation with clamp coupling

Please proceed as follows:

- Screw in clamp connection **6** with pressure connection **5** and pre-mounted sensor **4** into the welding socket **1** (use suitable sealing, e.g. flat ring sealing).
- Loosen screws **7** and **8** slightly, until the sensor **4** can be moved in axial direction.
- Move sensor in axial direction, until required insertion depth is reached.
- Align sensor into the direction of flow. The marking point at the upper end of the sensor shaft marks the upstream direction of flow.
- Tighten screw **8** (axial fixing) and screws **7** (sealing effect).

With this assembly a change of the insertion depths of the sensor is possible any time by repeating the above procedure.



5.4 Installation with clamp connection and ball valve

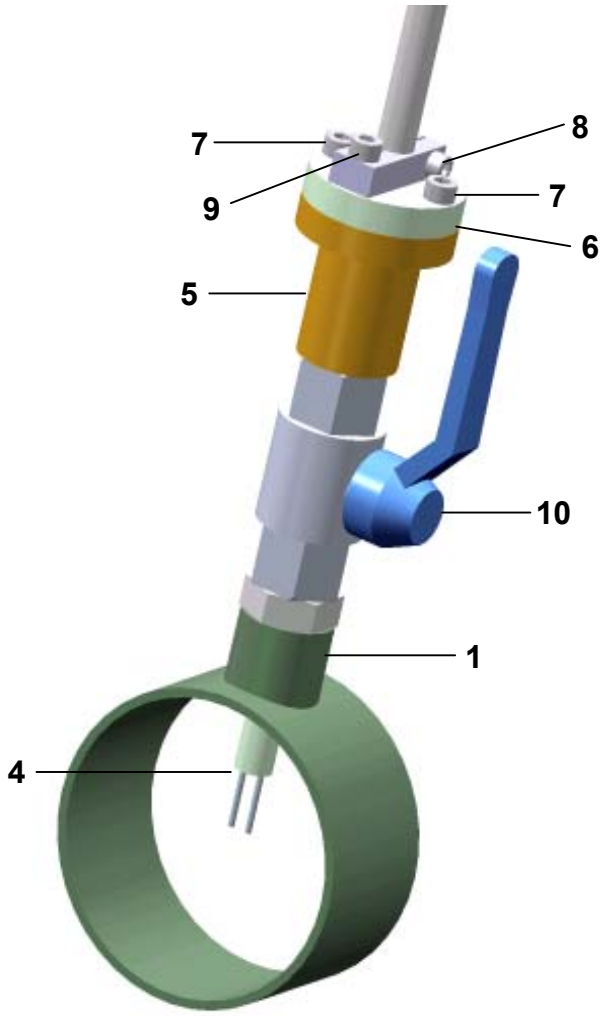
Attention ! Never move lever of ball valve when sensor is inserted!

Please proceed as follows:

- Screw in clamp connection **6** with pressure connection **5** an ball valve as well as pre-mounted sensor **4** into the welding socket **1** (use suitable sealing, e.g. flat ring sealing).
- Loosen screws **7** and **8**, until sensor **4** can be moved in axial direction.
- Move sensor in axial direction, until required insertion depth is reached.
- Align sensor into direction of flow. The marking point at the upper end of the sensor shaft marks the upstream direction of flow.
- Tighten screw **8** (axial fixing) and screw 7 (sealing effect).

With this assembly a change of the insertion depth or mounting/demounting of the sensor is possible at any time even with pressurized pipes.

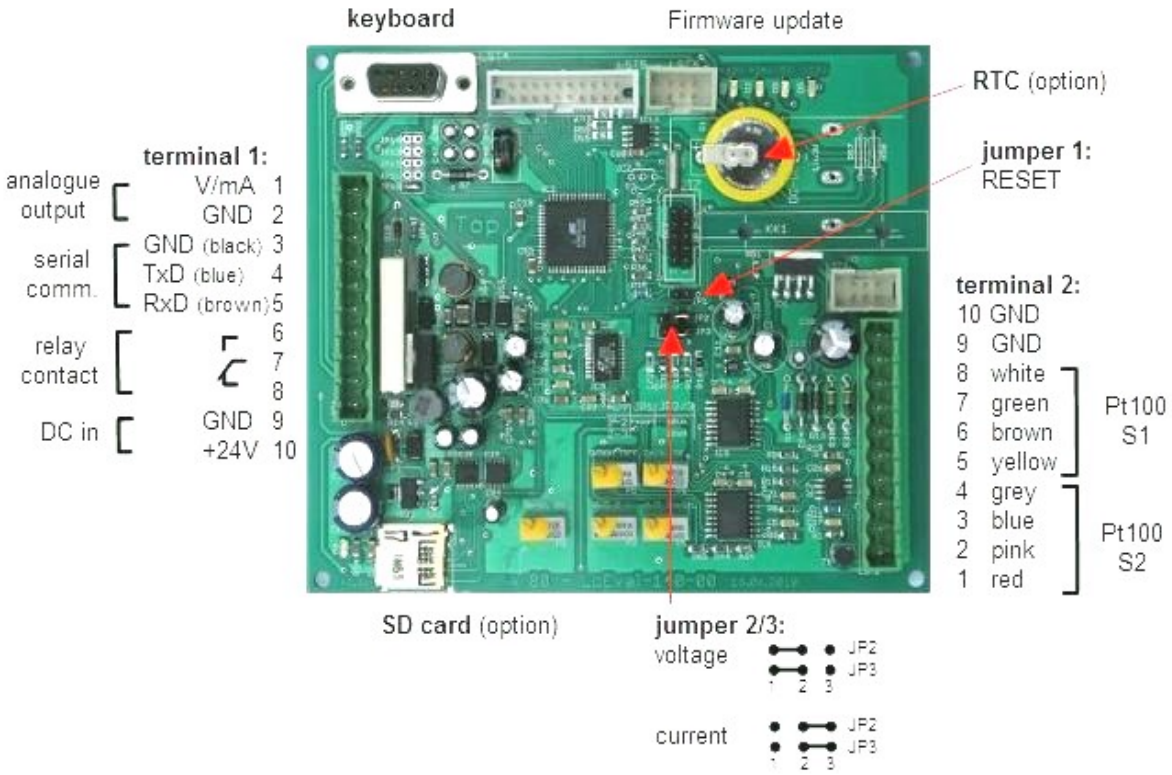
Please always consider, that when mounting or demounting the sensor in pressurized pipes shear forces up to about 12Kp are acting!!!



6. Connection of converter electronics

- Take off cover of electronics housing after loosening the screws.
- Sensor cable, power supply cable and if needed interface cable and signal cable for analogue output and relay output have to be led through the Pg-cable gland and connected according to the wiring diagram (diameter 0,2-2,5mm²).
- After having done the necessary connections the unit is ready for use.
- Replace cover of electronics housing and tighten the screws.

6.1 Within housing 150x150x57mm (small)



After starting the unit the LC-display shows for a few seconds the following information:

1.

```
SF-586b     v0.70
 NV_RAM: OK
CalTabName.tab
ADR.00    9.6kb/s
```

2.

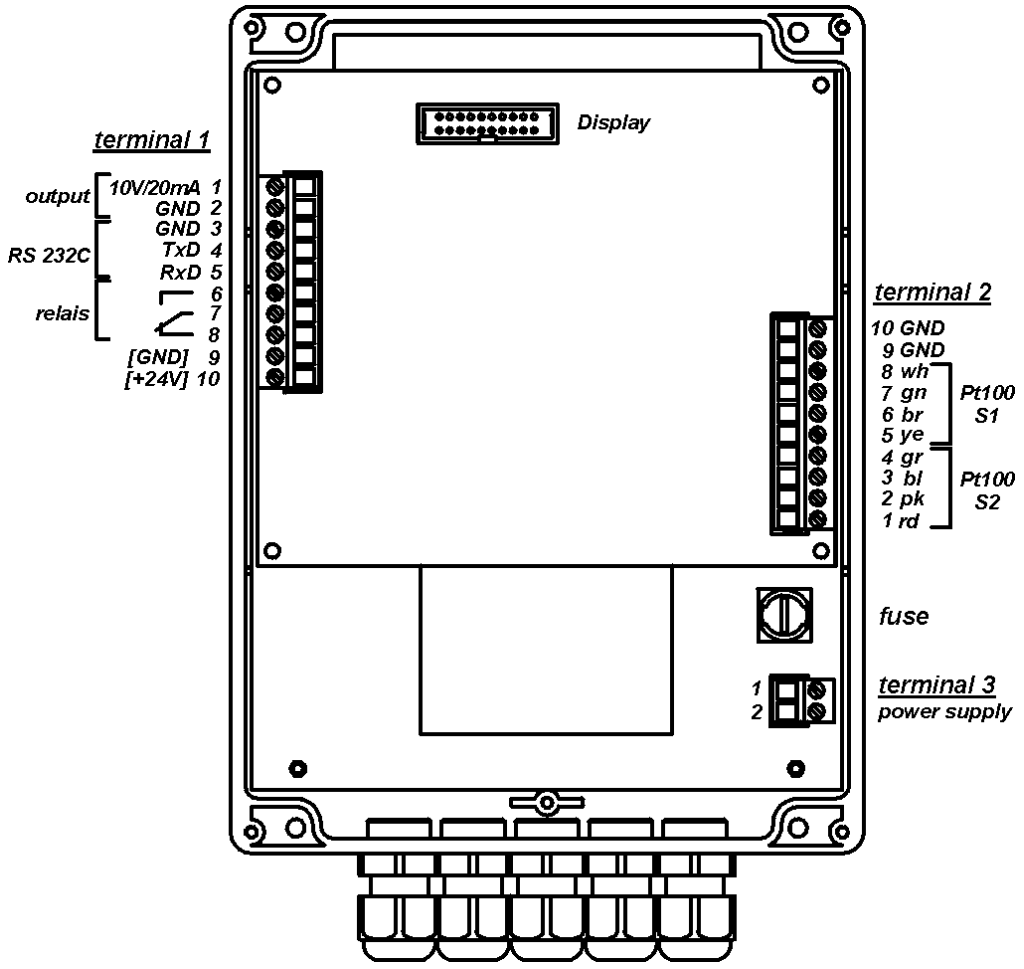
```
Client: 001
Temp.:  200°C
T-Diff:  40°C
Stand.: Norm
```

3.

```
COUNTER ----  ON
      1.234 Nm³
  123.456  Nm³/h
■■■■■■■■■■
```

The third picture is user defined. This is the last picture the customer have selected before POWER OFF.

6.2 Within housing 200x150x79mm (large)



The supply of the electronics is done via terminal 3 situated on the power supply printed circuit.

Terminal assignment

	115 -230 VAC	K3.1=AC / K3.2=AC
or	12 / 24 VDC	K3.1=plus / K3.2=minus

The valid connecting voltage and the assignment of terminal 3 are to be found in the specification and wiring diagram of the unit.

7. Signal outputs, inputs and indications

The used abbreviations of the terminal specification mean:
Figure before the point = number of terminal block
Figure after the point = number of connecting terminal

7.1 Analogue output (K1.1/K1.2)

The unit has a formatted analogue output signal in the ranges 0-10V or 0/4-20mA which is proportional to the mass flow and selectable with jumper between 0-10V or 0-20mA. Within the range 0-20mA an offset of 4mA can be added via software to adjust an analogue output 4 to 20mA.
The analogue output can be used in association with the software to achieve other parameters (see software description).

7.2 Relay change over contact (K1.6/K1.7/K1.8)

The unit utilizes a relay change over contact which is adjustable over the whole measuring range. Either the flow or the consumption can be controlled.
The relay change over contact can also be configured as pulse output (see software description).

7.3 Serial interface RS232C (K1.3/K1.4/K1.5)

The serial interface allows the communication with the PC to request the measured values. In addition the PC supplies parameter for the configuration,
(see software description)

7.4 Display

The unit consists of a LC-point matrix indication.
It indicates permanently the normal volume flow and the consumption.
Further more the display serves to indicate the software parameter and the alterations. The display is illuminated.

8. Technical data

8.1 Sensor

Operating principle:	calorimetric, primary signal proportional to mass flow (moisture must be avoided).
Medium:	compressed air, dry (normal density 0°C/1,013bara).
Measuring range:	0,6 - 60m/s (with reference to normal conditions).
Accuracy:*	< +/- 2% of measured value from > 5m/s, < +/- 0,1m/s if below 5m/s.
Repeat accuracy:	+/- 1% of measured value.
Operating pressure:	maximal 16bar absolute (higher on request).
Warming up timet:	about 5 minutes after power on.
Operating temperature:	-40°C to +100°C 0°C to +200°C 0°C to +300°C 0°C to +400°C 0°C to +420°C (set by order)
Surrounding temperature:	-40°C to +200°C
Installation position:	any.
Steadying distance:	30 x nom. pipe bore upstream, 10 x nom. pipe bore downstream. the min. steadying distance depends upon the application. Longer steadying distances have to be considered, if double elbows or partly closed valves have been installed in front of the unit. see also DIN1952.
Process connection:	clamp coupling with G½“ external thread.
Pressure range:	PN16 (higher on request).
Wetted parts:	sensor, clamp coupling and ball valve made of stainless steel (DIN1.4571). Sealing: VITON.
Protection class:	IP65.
Connecting cable:	standard 5m.
Sensor, lengths:	standard 120mm and 250mm, diameter: 12mm.
Sensor, weight:	120mm=270g, 250mm=310g
Clamp coupling, weight:	450g

* Calorimetric flow sensors normally needed no service, but however, electronic components get under influence of growing older and changing its electrical characteristics. Changing of the coating by corrosion and pollution could also influence the accuracy.
So it is necessary, from time to time (recommendation: about every 2 years) to check the calibration.

Measuring range limits (referred to air under normal conditions 0°C/1,013 bara) with inner diameter

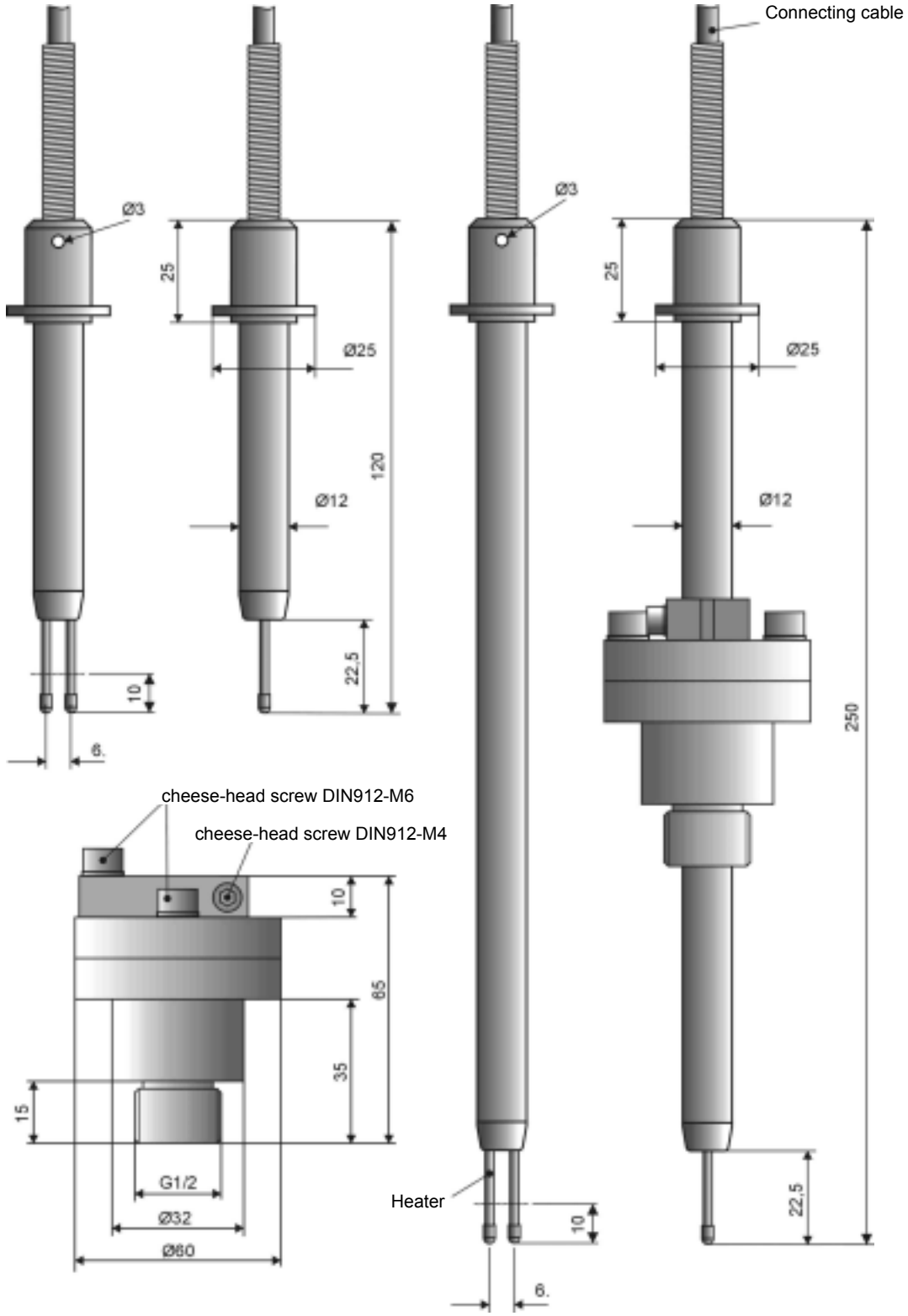
15-25	32	40	50	65	80	100	200	300	3000	mm
100	170	260	410	700	1.000	1.700	6.800	15.200	1.500.000	Nm³/h

8.2 Electronic converter

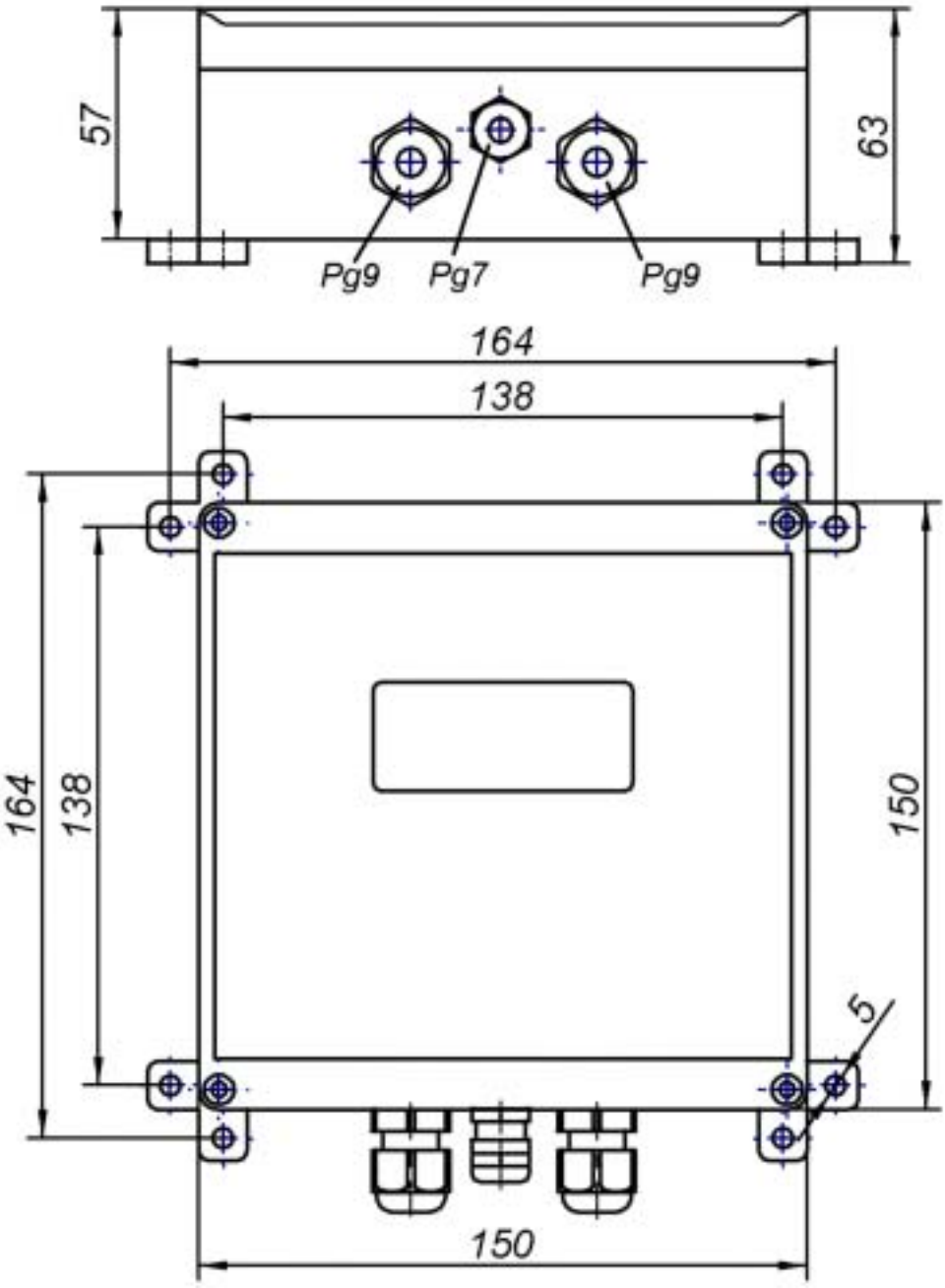
Operating principle:	constant over temperature regulator with microcontroller, curve correction over 60 point calibration table.
Power supply:	9-18VDC / 18-36VDC / 115-230VAC, consumption<10W.
Measuring range:	0,6 - 60m/s (with reference to normal conditions).
Full scale error:	< +/- 0,5% of measured value.
Warming up timet:	about 5 minutes after power on.
Display:	LC dot matrix display, 4 lines with 16 characters, illuminated.
Showing values:	mass flow and mass (counting), volume flow and volumene (counting), temperature.
Data protection:	EEPROM
Analogue output:	0-10Volt at RL > 1KΩ. 0/4-20mA at RB < 900Ω.
Relais, two-way contact:	relay type Siemens V23092, 250VAC / 6A.
RS232 interface:	bidirectional for data and configuration.
Analogue input (optional):	3 x 0-5VDC.
Power supply output: (optional)	3 x 5VDC or 12VDC, Pmax=250mW, factory setting.
Ambient temperature:	-20°C to +60°C.
Keyboard connector:	Pin2=TxD, Pin3=RxD, Pin5=GND, Pin7=GND, Pin8=KBC, Pin 9=+5VDC.
Terminal connector:	spring-cage connection (pluggable) for all inputs and outputs (max.1,0mm²).
Protection class:	IP 65.
Housing in mm:	150x150x57 oder 150x200x79 (WxHxL).
Wight:	small housing about 500g, large housing about 850g.
Accessories (optional):	optocoupler pulse output, second analogue out 0/4-20mA, data logger with SD-card and RTC, M-Bus, keyboard, numeric, 25 buttons.

9. Dimension data sheet

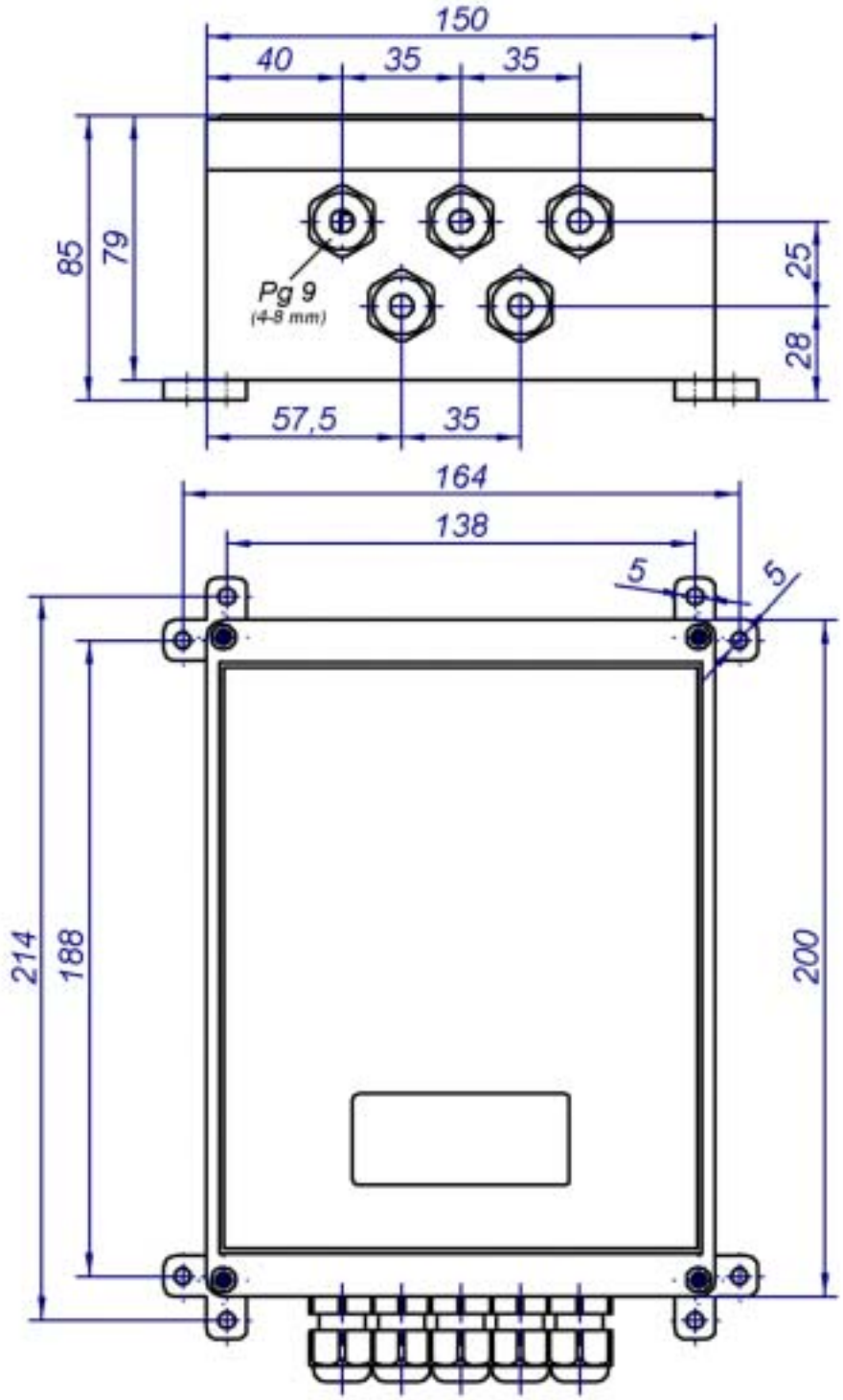
9.1 Drawing sensor and clamp coupling



9.2 Drawing small electronic housing 150x150x57mm

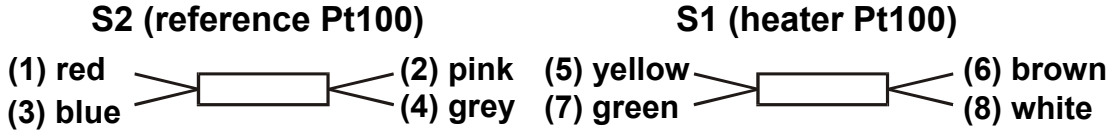


9.3 Drawing large electronic housing 200x150x79mm

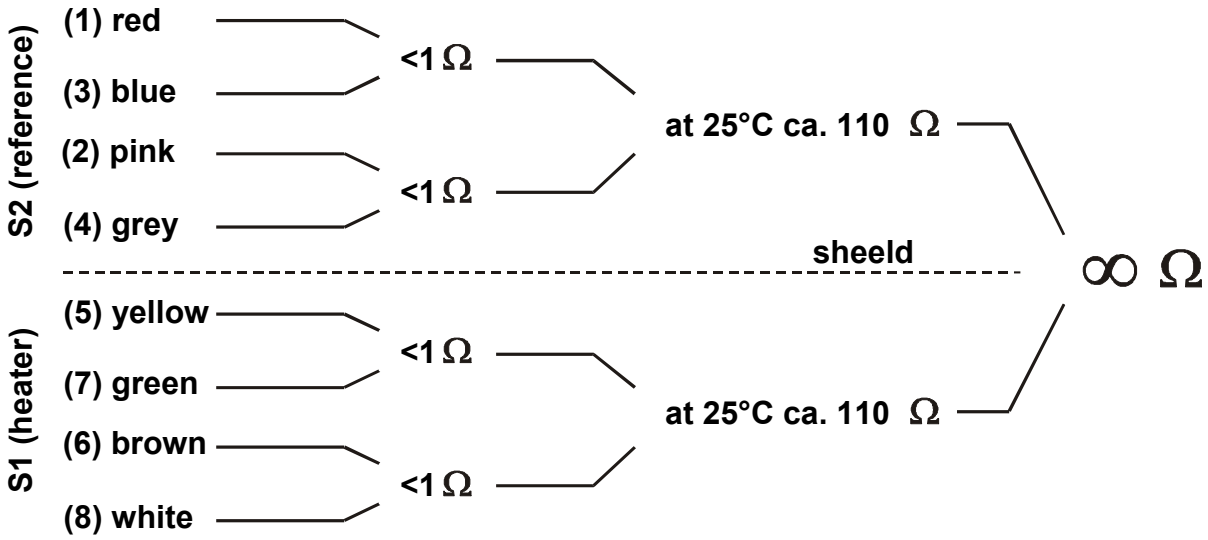


10. Instructions how to check the sensor

Cable connection



Cable test



Sensor check

-switch off power supply
-disconnect sensor
-check cables following above diagram using a Ω-meter

Important

no contact from shield to any line

11. Calculation of sensor surface and insertion depth

E (install length) when using seamless steel tubes for DIN2448					E for probe 250 [mm]	probe surface A [mm²]	E for probe 120 [mm]	probe surface A [mm²]	max. volume flow at 60m/s [Nm³/h]
nominal diameter	outer-Ø [mm]	inner-Ø D [mm]	wall S [mm]	X * [mm]					
DN50	60,3	54,5	2,9	6,3	235	45	105	45	494
DN65	76,1	70,3	2,9	8,1	234	52	104	52	827
DN80	88,9	82,5	3,2	9,5	232	57	102	57	1142
DN100	114,3	107,1	3,6	12,3	229	69	99	69	1930
DN125	139,7	131,7	4,0	15,1	225	81	--	--	2924
DN150	165,1	156,1	4,5	18,0	222	115	--	--	4108
DN200	219,1	206,4	6,3	23,7	214	184	--	--	7187
DN250	273,0	260,4	6,3	30,0	208	259	--	--	11447
DN300	323,9	309,7	7,1	35,6	202	327	--	--	16200

* Measure **x** showes the Aichelen point (position of the averaged flow velocity) at turbulent flow.

For calculating the following dimensions must be known:

D = inner pipe diameter [mm]
S = wall thickness of the pipe [mm]
L = sensor length [mm]

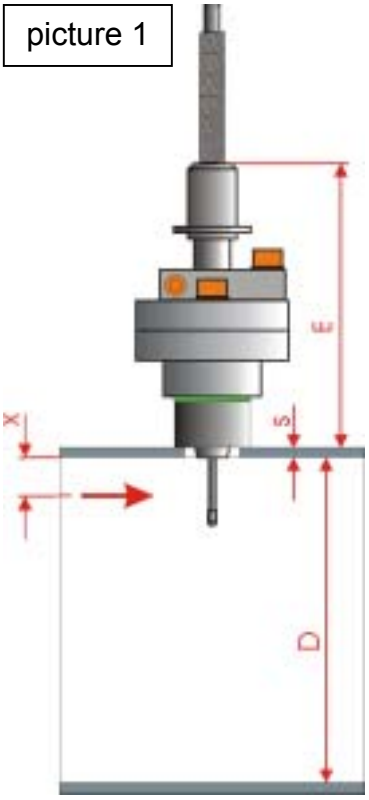
For the Aichelen point is valid:

Z = (0,115 x D) – 15 inner length of the sensor housing [mm]

if Z ≥ 0 then A = 80 + (12 x Z) surface of housing and both sensors [mm²]
if Z < 0 then A = 80 + (4 x Z) surface only of both sensors [mm²]

E = L – Z – S – 20 install length according to the drawing [mm]

picture 1

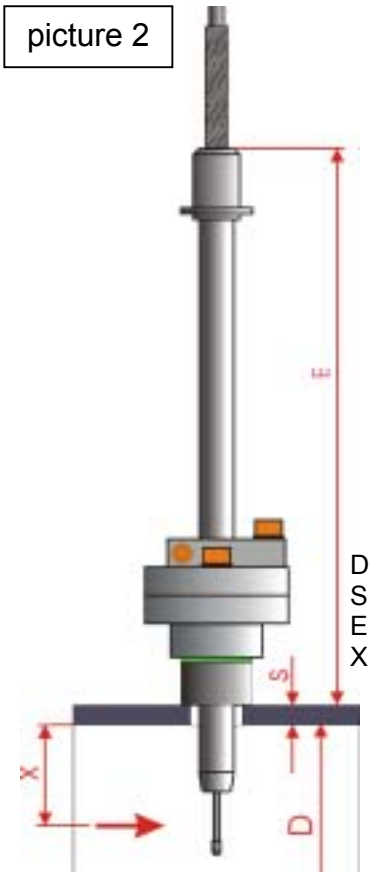


Description of the dimesions with samples:
[picture 1] 120mm probe in DN100
[picture 2] 250mm probe in DN300
[picture 3] 250mm probe in DN300 with ball valve

D = inner pipe diameter
S = wall thickness of the pipe
E = install length
X = Aichelen point

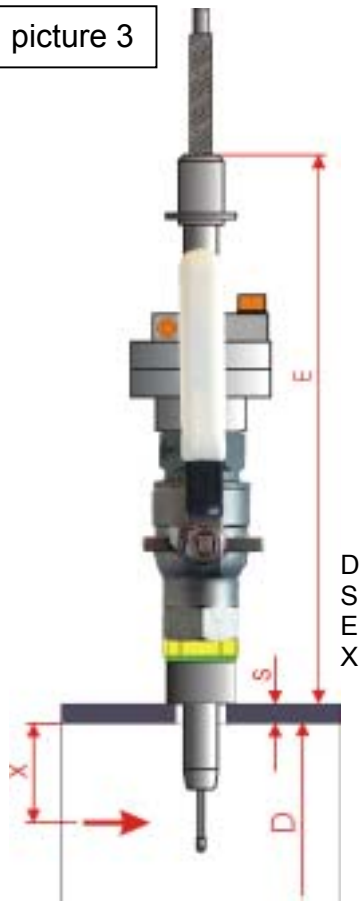
D = 107,1mm
S = 3,6mm
E = 99mm
X = 12,3mm

picture 2



D = 309,7mm
S = 7,1mm
E = 202mm
X = 35,6mm

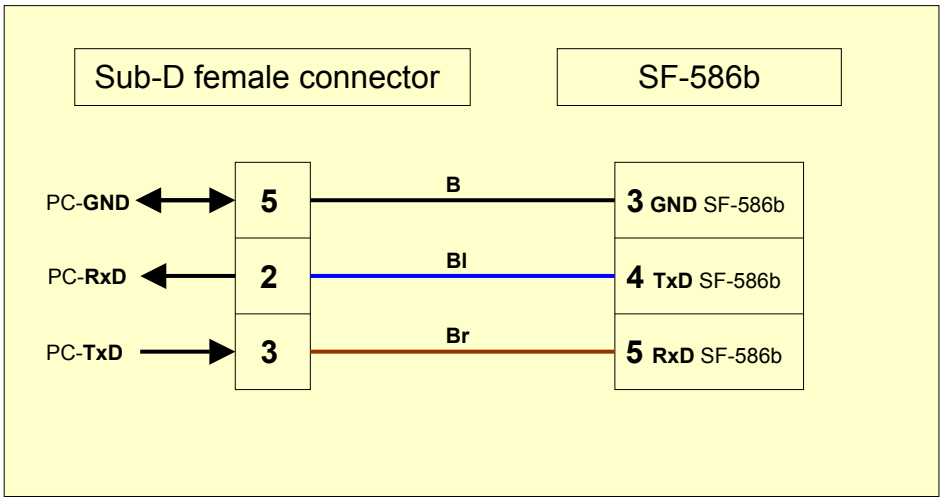
picture 3



D = 309,7mm
S = 7,1mm
E = 202mm
X = 35,6mm

12. Connecting with a PC

For connecting with a PC you need a cable with 3 lines and a female 9 pin Sub-D connector. For short cable length you need no shield. When using a shield, please connect it with PIN 5 (GND) only on the PC side.The connecting is shown in the following picture.
The colors of the three lines could be different when using other cables.



CONTACT

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